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U. S. DEPARTMENT OF COMMERCE

Technical News Bulletin

of the

National Bureau of Standards

★ *Issued Monthly* ★

Washington **March 1945**[1] **Number 335**

CONTENTS

	Page
Renewal of "E" award	19
New resistance thermometer	19
Thermal properties of water	20
Specific heats of chemical compounds used in synthetic rubber manufacture	20
Heats of combustion and formation of the paraffin hydrocarbons	21
Free energies and equilibria of isomerization of the 18 octanes	21
Vapor pressure, latent heat of vaporization, and triple-point temperatures of nitrous oxide	21
Purity of samples of organic solvents	21
Reducing sugar analysis	22
Sizing materials for warp yarns	22
Machine for splitting mica	22
Highly hydrated dolomitic masonry limes	23
Commercial vinsol resin cements	23
Identification of corrosive soils	24
Tests of prestressed reinforced-concrete pipes	24
Proposed simplified practice recommendation for clay sewer pipe	24
Revised commercial standard for porcelain-enameled steel utensils	25
New supplement to list of publications	25
List of mathematical tables	25
New and revised publications issued during February 1945	26
Mimeographed material: Letter Circulars	26
Recent articles by members of the Bureau's staff published in outside journals	26

RENEWAL OF "E" AWARD

The Bureau has received the following letter, dated January 25, 1945, from Admiral C. C. Bloch, chairman of the Navy Board for Production Awards:

"The Army and Navy congratulate the National Bureau of Standards on being one of the first to be awarded a fifth renewal of the Army-Navy 'E' Award. In recognition of this honor, granted at the last meeting of the Navy Board for Production Awards, a new flag with five stars is being forwarded. This flag should arrive at your plant in the near future.

"During the past year the four stars on your 'E' flag have evidenced your outstanding production achievements. During the coming year the five stars on the 'E' flag proudly flown over your plant will be proof to everyone that the National Bureau of Standards is continuing to do its utmost to assist the Army and Navy.

"The members of the Armed Forces highly appreciate the inspiring record which has been established by the untiring efforts of each and every man and woman in your plant."

The first "E" pennant was awarded to the Bureau by the Navy Department, Bureau of Ordnance, on February 21, 1942. The presentation ceremony is described in Technical News Bulletin No. 299 (March 1942). At that time each member of the staff was given a special lapel button or pin commemorating the event and carrying the names of the Bureau of Ordnance and the National Bureau of Standards. Later, these awards were made in behalf of both the Army and Navy and a uniform "E" pin was adopted.

NEW RESISTANCE THERMOMETER

Peter G. Strelkov, of the Institute for Physical Problems of the Academy of Sciences, U. S. S. R., is visiting the Bureau. He brought with him five precision resistance thermometers of a new and ingenious design developed by him-

[1] Published with approval of the Director of the Budget.

self in Moscow after examining the types in use in the United States and other countries. The new thermometers are enclosed in quartz and the resistance coil is supported on a quartz helix in a novel manner that should simplify construction. These thermometers will not carry quite so much measuring current as those designed here and their response to temperature changes is somewhat slower, but in quality of platinum used and in apparent constancy, they are the equal of any that have been built here or have come to the Bureau's attention. These thermometers are being given a full National Bureau of Standard's certification for the entire range of temperatures for which such thermometers are adapted.

THERMAL PROPERTIES OF WATER

There is nothing new about steam tables; mechanical engineers have used them in engine design and operation for nearly 100 years, but the preparation of tables covering adequately the pressure and temperature ranges that are now common is a comparatively recent development. In 1923 the American Society of Mechanical Engineers sponsored researches on water and steam at several laboratories, and requested the Bureau to determine the specific heat of liquid water and its heat of vaporization. In his address as retiring president of the Philosophical Society of Washington on January 6, H. F. Stimson reviewed the Bureau's part in this project. He pointed out that the late N. S. Osborne, in taking up the Bureau's assignment, first studied the theory of "calorimetry of saturated fluids" and then proceeded to use this theory for the measurement of the enthalpy (formerly called total heat or heat content) of saturated liquid water and water vapor from 0° C to the critical temperature at 374.15° C. The precision of his results was such that it is hoped they will meet every requirement of engineering practice for years to come. The vapor pressure of water was also determined from 100° to 374° C.

The vapor pressure of water between 0° and 100° has not been carefully determined since 1909, but a precision manometer has been developed with which Dr. Stimson plans to make measurements at pressures below 2 atmospheres. The vapor pressure of water can be measured with this manometer, to a higher relative precision than the precision to which the corresponding temperature can be measured with platinum resistance thermometers calibrated at the steam and ice points by routine methods. The calibration of thermometers at 100° C can be done with this precision manometer to an accuracy of 0.0001°. In order to obtain this same accuracy for calibrations near the ice point, the triple point of pure water was used. Special triple-point cells have been made and a technic developed that is suitable for precision calibration of thermometers. The temperature of the triple point was determined to be 0.0100° C.

SPECIFIC HEATS OF CHEMICAL COMPOUNDS USED IN SYNTHETIC RUBBER MANUFACTURE

For research on synthetic rubber it is important to have as much information as possible concerning the properties of the chemical compounds used. A program for obtaining such information has been in progress at the Bureau for several years. Recently, Russell B. Scott and Jane W. Mellors have determined the specific heats of the vapors of four compounds, 1,3-butadiene, isobutene, styrene, and ethylbenzene. (Journal of Research for March, RP1640.) Butadiene and styrene are the principal ingredients of GR-S (Government rubber-styrene type). Isobutene is copolymerized with isoprene in the manufacture of butyl rubber. Ethylbenzene is converted into styrene by dehydrogenation, this process supplying most of the styrene used.

The specific heat of a substance is the amount of heat required to raise the temperature of unit mass of the material 1 degree. Specific heats of solids, liquids, and vapors are of value in calculating the amounts of heat involved in plant processes, but the specific heat of a vapor has a more fundamental significance, because of its simpler relationship to the internal motions of the atoms within the molecule. In the case of some compounds, it is possible to calculate the specific heat of the vapor by using spectroscopic data only. With more complicated molecules, such as those dealt with in the present study, the spectroscopic data alone do not permit the complete solution; calorimetric data extending to very low temperatures must also be utilized. In addition, certain assumptions must be made before values of specific heat can be calculated. It is in these cases that the experimental values of specific heat are very useful. If the calculated values agree with the

experimental, the accuracy of the assumptions is demonstrated, and it is possible to calculate specific heats at high temperatures where the experimental method would be unsatisfactory. The calculations are not limited to specific heats. Other thermodynamic properties, which enable the chemist to predict reactions and compute changes of heats of reaction with temperature, can also be obtained. The measured specific heats of the vapor provide one of the best checks of the accuracy of these calculations.

HEATS OF COMBUSTION AND FORMATION OF THE PARAFFIN HYDROCARBONS

In a report (RP1642) by Edward J. Prosen and Frederick D. Rossini, which will appear in the March number of the Journal of Research, selected "best" values are given for the heats of combustion (in oxygen to form gaseous carbon dioxide and liquid water) and the heats of formation (from the elements solid carbon, graphite, and gaseous hydrogen) for methane and ethane in the gaseous state, and for all the paraffin hydrocarbons from propane through the octanes and all the higher normal paraffins through C_{20}, in both the liquid (except for one octane which is solid) and gaseous states, all at 25° C. Values for the normal paraffins above C_{20} are given in the form of equations. A new and more accurate value for the increment per CH_2 group, for both the liquid and gaseous states, is given for the heat of combustion and correspondingly for the heat of formation.

FREE ENERGIES AND EQUILIBRIA OF ISOMERIZATION OF THE 18 OCTANES

A joint report of the Bureau's Thermochemical Laboratory and the American Petroleum Institute Research Project 44, prepared by Edward J. Prosen, Kenneth S. Pitzer, and Frederick D. Rossini, appearing in the March number of the Journal of Research (RP1641), presents in tabular and graphical form, for the 18 octanes, in the ideal gaseous state (range 298° to 1,000° K), values of the following thermodynamic properties: (a) The standard free energy of isomerization divided by the absolute temperature, $\Delta F^\circ/T$; and (b) the relative amounts of the several isomers present at equilibrium with each other.

The values presented in this report for the octanes follow substantially the general conclusions previously drawn for the butanes, pentanes, hexanes, and heptanes as regards thermodynamic stability in the gaseous state:

(1) At 25° C, the normal isomer is among the isomers of lesser stability. Relative to the other isomers, the normal isomer increases in stability with increase in temperature, and at 1,000° K is among the most stable of the isomers.

(2) At 25° C, 2,2-dimethylhexane is among the most stable of the isomers, but it rapidly becomes less stable with increasing temperature and at 1,000° K is among the least stable of the isomers.

(3) The more highly branched isomers are among the least stable at the higher temperatures.

VAPOR PRESSURE, LATENT HEAT OF VAPORIZATION, AND TRIPLE-POINT TEMPERATURES OF NITROUS OXIDE

Nitrous oxide (N_2O) is widely used as an anaesthetic. In many physical properties N_2O is remarkably similar to carbon dioxide, but its triple-point pressure is less than 1 atmosphere, so that unlike "dry ice", it cannot exist as a solid which does not melt at atmospheric pressure.

Harold J. Hoge of the Bureau's Low Temperature Laboratory has obtained new data on the vapor pressure and heat of vaporization of N_2O. His results, which will be published as RP1644 in the March Journal of Research, should be of interest to manufacturers and commercial users as well as to scientific workers. Tables are given both in scientific and in engineering units.

The triple point of N_2O gives promise of being a satisfactory thermometric fixed point at which the calibration of thermometers may be checked. The triple-point temperature found in the investigation is −90.809° C (−131.456° F), or 182.351° K.

PURITY OF SAMPLES OF ORGANIC SOLVENTS

Studies of the uniformity of different samples of organic solvents by ultraviolet spectrophotometry are described in a paper (RP1643) by Marion E. Maclean, Priscilla J. Jencks, and S. F. Acree in the March number of the Journal of Research. The procedure used is applicable to the detection of impurities originally present or formed by deterioration, and to the study of the effectiveness of purification procedures.

Absorption curves are given for *n*-heptane, 2,2,4-trimethylpentane, cyclo-

hexane, methylcyclohexane, decahydronaphthalene, benzene, carbon tetrachloride, methyl alcohol, ethyl alcohol, ethyl acetate, and dioxane, in two or more grades of purity. The absorption curves of tetrahydronaphthalene, toluene, xylene, chlorobenzene, ethylene dichloride, trichloroethylene, acetone, dimenthyldioxane, and carbon bisulfide are discussed briefly. The effect of filtration through silica gel on the ultraviolet absorption of several commercial solvents is shown.

REDUCING-SUGAR ANALYSIS

In the determination of reducing sugars, copper solutions containing carbonates and bicarbonates have in general proved to be less reliable, as regards reproductibility of results, than copper solutions containing caustic alkali. However, since the carbonate solutions are less destructive to sucrose, Richard F. Jackson (deceased) and Emma J. McDonald made a study of the macro method proposed by Shaffer and Hartmann for dextrose analysis. This method has been applied to dextrose, levulose, invert sugar, and invert sugar-sucrose mixtures. The copper-sugar ratios have been determined in each case.

As pointed out in the March Journal of Research (RP1638), even under carefully controlled conditions, the Shaffer and Hartmann method proved to be inferior to Munson and Walker's and to Lane and Eynon's methods, in which caustic alkali is a constituent of the copper reagent. However, because of its convenience, it is valuable for rapid work where a precision not greater than 0.5 percent is required.

SIZING MATERIALS FOR WARP YARNS

In weaving cloth, the warp yarns must be treated in some way to protect them from the stress and abrasive action to which they are subjected in the loom. As spinning and weaving equipment has been improved, it has become possible to produce finer yarns and to weave at higher speeds, which means that the warp yarns must withstand more severe conditions. Furthermore, the increased use of spun rayon yarns and the introduction of water-soluble synthetic resins for textile uses have presented so many new problems that empirical methods of solving them are no longer adequate.

Through a grant from the Textile Research Institute, the Bureau has been able to study spun rayon warp sizing in terms of present standard equipment and methods, with a view to finding some simple tests which might be used to evaluate the sizing efficiency of various materials. Products now commonly used for warp sizing, as well as some showing promise of future development, were investigated, and through the courtesy of W. E. Shinn, Charles Hedrick, and J. G. Lewis, experiments in actual weaving were conducted at the Textile School, North Carolina State College at Raleigh, N. C.

In general, a fairly consistent relationship was found between the sizing efficiency and the deformability of films made from sizing materials. The stiffness of the cloth and the "hardness" of the films also were related to the weaving efficiency of the size. Flow curves made on the films were useful in studying the effect of softeners in the sizing mixture. The strength and ultimate elongation of the sized yarn were not related to its weaving quality, and appeared to be little affected by the type of size as long as the amount of size on the yarn was comparable. Although it was not proved by direct tests on yarns, there was some evidence which suggests that as softeners oil and tallow have a different action than glycerin.

MACHINE FOR SPLITTING MICA

D. W. Kessler of the Bureau has been working on the problem of a feasible means of removing mica films, in thicknesses between one and three mils, from commercial mica blocks. This is to be substituted for hand splitting—the method that has always been employed. It requires 3 or 4 months to train a hand-splitter, and the average rate of splitting is between 15 and 20 films per minute.

When this project was undertaken, various chemicals were tried to determine if the cementing material holding the sheets together could be dissolved. Several physical means, such as high-voltage electricity, heat, sudden release of air pressure in the container, flexing, steaming, sudden changes of temperature, etc., were tried. Most of these methods gave no promise whatever, and those that showed some tendency to separate the films produced other effects that were undesirable. Efforts were then started to develop a machine that would remove films one by one.

Two devices for splitting mica have been constructed at the Bureau. The first consists of a single suction chuck plate which holds the mica blocks while

it slides back and forth on a track. The gage which starts the split is stationary except for a slight rotation in a vertical plane. When a film is started and bent upwards, it is caught by two claws actuated by suction, and pressed on a small drum. As the drum rolls back, the film is stripped and carried to a suction belt which deposits it in a tray at some distance from the machine. This device produces about 30 films a minute, the slow rate being caused mainly by the fact that the operation has to be stopped while new blocks are being placed on the chuck. The method of stripping is also believed to be too severe, since the bending of films caused more scales and defective sheets than hand splitting.

The second device consists of a disk carrying six chuck plates, a starter gage similar to the first, two stripper blades, and a suction belt for removing the films from the machine. With this device little time is lost in changing blocks, since one chuck is loaded by the operator while another block is being split. When the first block is finished, the operator turns the disk until the chuck comes into position which requires only about 1 second for the change. With this device there is very little bending of the films, and the results are more satisfactory. It has been demonstrated to representatives of the War Production Board, who have shown keen interest and expressed their belief that it will be of value to the industry.

HIGHLY HYDRATED DOLOMITIC MASONRY LIMES

The National Lime Association Fellowship at the Bureau is conducting a survey of structural limes. Included in this investigation is a group of a new type, the highly hydrated dolomitic limes, which differ from the normal dolomitic limes in that a major percentage of the magnesium oxide is hydrated. For the study of these new limes, samples of all the commercially available products were secured, these coming from widely separated geographical locations.

A report of the results of the tests on all six of the highly hydrated dolomitic limes produced for masonry use has been prepared by G. J. Fink and Emil Trattner, research associates, and has been submitted for publication in the 1945 Annual Proceedings of the American Society for Testing Materials.

The limes contained only relatively small percentages of unhydrated magnesium oxide and showed low expansions in the autoclave when tested in the form of bars made from neat cement-lime pastes. They exhibited high plasticities not only when soaked overnight but also when tested 25 to 30 minutes after wetting.

Cement-lime mixtures, in the ratio of 1 bag of portland cement to 2 bags of lime, tested as masonry cements, possessed high water retentivities, greatly exceeding the ASTM and Federal Specification requirements for masonry cement. The compressive strengths of the mixtures from five limes exceeded the latter requirement of 1,000 lb/in.^{2} for Type II masonry cement and with the sixth was 990 lb/in.^{2}

The 1:2:9 by volume, masonry sand mortars exhibited remarkably good workabilities and unusually high water retentivities. The compressive strengths of these mortars from all the limes exceeded the 600 lb/in.^{2} requirement for Type B mortars of the American Standard Building Code Requirement for Masonry, although they were Type C under the proportion classification of the Code.

In order to simulate the conditions of job use, additional 1:2:9 mortars were also tested 30 minutes after mixing, and after the mortars had been subjected to suction for 1 minute. These mortars had essentially the same water retentivities and more uniform but slightly higher compressive strengths than the mortars tested immediately after mixing.

All the limes and their mortars proved to be unusually uniform in their properties.

COMMERCIAL VINSOL RESIN CEMENTS

The Bureau recently completed tensile and plastic mortar compressive strength tests of the 64 commercially manufactured portland cements containing Vinsol resin, mentioned in Technical News Bulletin No. 330 (October 1944).

An analysis of the test results has been made, using the coefficient of variation as the measure of the scatter and distribution of the strengths of the 64 cements when tested by the two methods. The coefficient of variation for the compressive strength values was about twice as great as for the tensile strengths. It appears, therefore, that the compressive strength test discloses differences between the cements that are not revealed by the tensile test. Furthermore, previous work has indicated that the compressive strength values of

plastic mortar cubes are more reproducible and more indicative of the compressive strength of concrete than are the strength values obtained on the tensile briquettes.

IDENTIFICATION OF CORROSIVE SOILS

Soils are generally air-dried to obtain comparable results in the measurement of pH. In the Journal of Research for March (RP1639), Melvin Romanoff points out the unreliability of such a procedure in measuring the pH of soils for the identification of corrosive areas. For instance, air-drying of a sample of a poorly drained soil caused the reaction to change from neutrality to high acidity. Air-dried samples, when saturated and sealed in containers with complete exclusion of air returned to the neutral condition. After air-drying the same samples again, the pH values indicated the development of acidity. By controlling the conditions of saturation and aeration, the hydrogen-ion concentration of this soil was caused to pass through a complete cycle from neutrality, as was found in nature, to high acidity, as was observed in the air-dried state.

Qualitative examination for the presence of sulfides gave positive tests for the fresh, moist soil, and negative tests for the well-aerated samples.

The results suggested a further investigation, which was made on 62 air-dried soils taken from the Bureau's soil-corrosion test sites. These samples were saturated and stored with the exclusion of air for almost a year. Significant changes in pH were observed in the majority of the samples, and large changes in many of them.

Some of the results justify the association of the change in pH value with the activity of anaerobic sulfate-reducing microorganisms. These bacteria, under certain conditions favorable to their growth, have the property of reducing sulfates present in the soil to sulfides. Aerating the soil results in slow oxidation of the sulfides, and unless there are other factors present in the soil which may produce changes in hydrogen-ion concentration, the soil reaction changes from neutrality to high acidity.

As a result of this study it has been concluded that, for the identification of areas corrosive to iron and steel, pH measurements of soils should be made only on samples in the field or on samples maintained in the natural condition.

TESTS OF PRESTRESSED REINFORCED CONCRETE PIPES

The increasing use of prestressed reinforced concrete pipe for conveying liquids under pressure has created an interest in the behavior of the pipe in this service and its resistance to forces that may be applied from the outside either by the weight of the covering material or by the irregularity of the bearing strength of the supporting soil.

Culbertson W. Ross of the Bureau's masonry constructions section, working in cooperation with the Water Division of the District of Columbia, has made tests on prestressed concrete pipe containing a steel cylinder. The internal diameters of the specimens were either 20 or 30 in. They consisted of a concrete lining, thickness 1.22 and 1.85 in., a steel cylinder, thickness 0.06 in., a wrapping of steel wire under high stress, equivalent to 0.0284 and 0.0354 lb/in.^{2} per inch of pipe, and a mortar covering, thickness ¾ in.

The maximum internal pressure, the crushing strength, and the load supported at the center of a 14-ft span of pipes with internal diameters of 20 in. were 740 lb/in.^{2}, 12,300 lb/ft^2, and 55,000 pounds, and for the pipes with internal diameters of 30 in. were 600 lb/in.^{2}, 13,000 lb/ft^2, and 140,000 lb. These data and also the changes of the strain of parts of the pipes during the tests are given in a report that has been submitted to the American Concrete Institute. The pipes had been designed for a working pressure of 165 lb/in.^{2}, but the tests indicate that the pipes have a considerable factor of safety.

PROPOSED SIMPLIFIED PRACTICE RECOMMENDATION FOR CLAY SEWER PIPE

A proposed simplified practice recommendation for clay sewer pipe has just been submitted to all interests for acceptance or comment. Representing an effort to retain in the post-war period some of the benefits which resulted from the War Production Board's Limitation Order L–316, it lists the variety of standard-strength and extra-strength pipe and fittings that should be considered as stock items. The information is presented in two schedules, A and B, the latter covering practice in certain western states.

The need for Schedule A and Schedule B was recognized as desirable when simplified practices were established by the War Production Board, and the provisions of Schedule B have been found

to be so satisfactory that they appear in this proposal exactly as given in the limitation order. Schedule A, as regards varieties listed, is more liberal than the limitation order. Standard-strength items total 326 as compared with 290 in the order, and extra-strength items total 192 as compared with 120 in the order. The total of 519 is still much below the 1,500 to 1,600 items formerly carried by the industry. If the recommendation as proposed or as adjusted is found to be generally satisfactory, it will become effective on the expiration of Limitation Order L–316. Mimeographed copies may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington 25, D. C.

REVISED COMMERCIAL STANDARD FOR PORCELAIN-ENAMELED STEEL UTENSILS

The Bureau has just released the printed edition of Commercial Standard CS100–44, Porcelain-Enameled Steel Utensils (Second Edition), which has been accepted as a recorded standard of the industry.

As compared with the earlier issue (CS100–42), the scope of the 1944 edition has been broadened to cover both single-coated and multiple-coated utensils, and improvements in quality have been recognized by increasing the severity of requirements for boiling acid-resistance and thermal shock. The standard records for the benefit of all concerned, requirements on impact resistance, boiling acid resistance, resistance to thermal shock, requirements and tolerances for capacity of enameled utensils used for cooking, household, food storage, and hospital use. Detailed methods of test are included for determining compliance with the standard, as well as the wording of a label for use by manufacturers and distributors in guaranteeing compliance with the standard as a means of protecting the purchaser.

The standard became effective for new production on October 25, 1944. Copies are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 10 cents each.

NEW SUPPLEMENT TO LIST OF PUBLICATIONS

Unforeseen developments delayed the issuance of the 2-year Supplement to Circular C24, the list of publications of the Bureau, which was mentioned as "in press" a year ago. However, this is now available and brings the list up to June 30, 1944. The complete list (Circular C24 and three supplements) is available by purchase from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., as follows:

Circular C24, 7th edition (covering the period 1901 to June 30, 1925)	$0.35
1925–1931 Supplement to C24 (covering the period July 1, 1925, to December 31, 1931)	.25
1932–1941 Supplement to C24 (covering the period January 1, 1932, to December 31, 1941, with subject and author indexes covering the period 1901 to 1941)	.50
1942–1944 Supplement to C24 (covering the period January 1, 1942, to June 30, 1944, with subject and author indexes)	.20
Complete list	1.30

Abstracts of the papers listed are given in each case.

LIST OF MATHEMATICAL TABLES

A new list of material prepared by the Mathematical Tables Project is now available as Letter Circular LC777.

The above Project was started in January 1938 by the Works Project Administration for the city of New York, under the sponsorship of the Bureau. When the WPA was discontinued the Bureau took over the operation of the Project, with the support of the Office of Scientific Research and Development, the determination of the program being vested in the Applied Mathematics Panel of the National Defense Research Committee. Although major emphasis is being placed on the computation of tables directly related to the war, an effort is being made to complete various tables that were under way when the WPA was discontinued. A mailing list is maintained at the Bureau for those who wish to receive announcements of new tables as they become available.

It has been the policy of the Project to select for tabulation mathematical functions of fundamental importance; in this selection and in the choice of the most useful range and interval of the argument, advice has been sought from mathematicians, physicists, and engineers in this country and abroad.

The present list includes all tables that have been published by the Project for general distribution. Thirty-one of these tables are available from the

Bureau, two are obtainable from the Government Printing Office, four from Columbia University Press, and ten can be consulted in various mathematical journals. This is all clearly set forth in the Letter Circular. Copies of LC777 are obtainable without charge from the Information Section, National Bureau of Standards, Washington 25, D. C.

NEW AND REVISED PUBLICATIONS ISSUED DURING FEBRUARY 1945

Journal of Research[2]

Journal of Research of the National Bureau of Standards, volume 33, number 6, December 1944 (RP1618 to RP1623, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers[2]

[Reprints from November 1944 Journal of Research]

RP1612. Thermal-density coefficients and hydrometer correction tables for vegetable tanning extracts. Mary Grace Blair and Elmer L. Peffer. Price 5 cents.

RP1613. Measurement of rate of flow of water through filter paper. Herman Bogaty and Frederick T. Carson. Price 5 cents.

RP1614. Attack of refractory platiniferous materials by acid mixtures at elevated temperatures. Edward Wichers, William G. Schlecht, and Charles L. Gordon. Price 10 cents.

RP1615. Improved reflux regulator and head for laboratory distilling columns. Charles B. Willingham and Frederick D. Rossini. Price 5 cents.

RP1616. Preparation of salts of galacturonic acid from beet pulp. Horace S. Isbell and Harriet L. Frush. Price 5 cents.

RP1617. Preparation of sodium strontium galacturonate from citrus products. Harriet L. Frush and Horace S. Isbell. Price 5 cents.

Simplified Practice Recommendations[2]

R186–44. Cotton canton flannels for work gloves. (Supersedes R186–42.) Price 5 cents.

R205–44. Iron and steel relief valves for petroleum, chemical, and general industrial services. Price 5 cents.

R206–44. Swiss pattern files. Price 5 cents.

Technical News Bulletin[2]

Technical News Bulletin 334, February 1945. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC777. Mathematical tables. . (List of tables prepared by the Mathematical Tables Project.)

LC778. Acoustics: Publications by the staff of the National Bureau of Standards. (Supersedes LC636.)

LC779. Materials and methods of X-ray protection.

RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS[3]

Wearing quality of some vegetable-tanned sole leathers. R. B. Hobbs and R. A. Kronstadt. J. Am. Leather Chemists Assn. (Ridgway, Pa.) 40, 12 (January 1945).

Advances in plastics during 1944. G. M. Kline. Modern Plastics (122 East 42d St., New York 18, N. Y.) 22, 93 (January 1945).

William Malcolm Corse, obituary. H. S. Rawdon. J. Wash. Acad. Science (450 Ahnaip St., Menasha, Wis.), 35, No. 1, 32 (January 15, 1945).

War research at the National Bureau of Standards. Lyman J. Briggs. The Washington Scientist (819 13th St. N.W., Washington 5, D. C.) 1, No. 1, 6 (February 1945).

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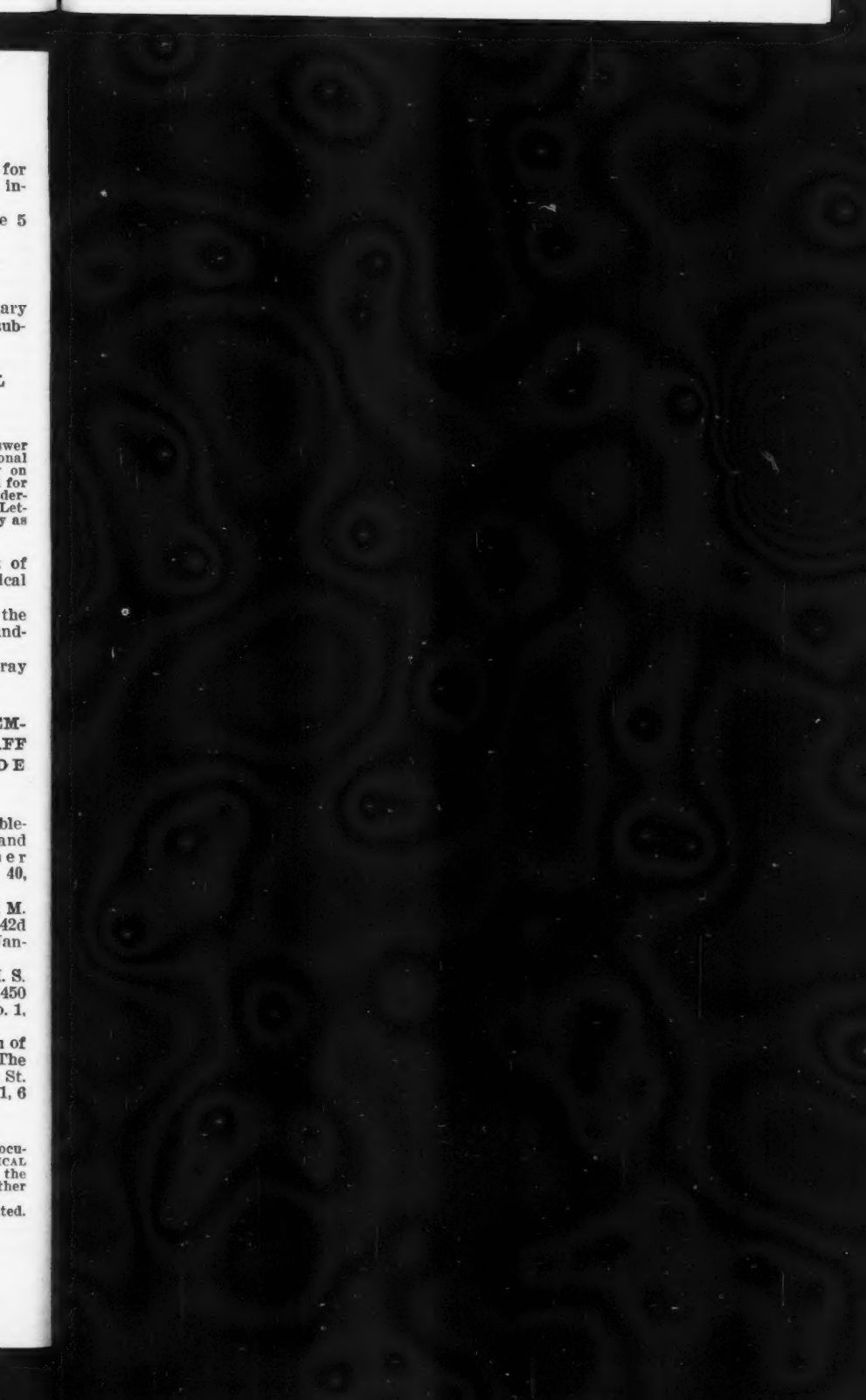
[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription to TECHNICAL NEWS BULLETIN, 50 cents a year; Journal of Research, $3.50 a year (to addresses in the United States and its possessions and to countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

[3] These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.

U. S. GOVERNMENT PRINTING OFFICE: 1945